US ARMY RDECOM

Modeling Architecture for Technology MATREX Research and EXperimentation

SFC Paul Ray Smith Simulation & Training Technology Center (STTC)

SFC PAUL RAY SMITH SIMULATION & TRAINING TECHNOLOGY CENTER • UNITED STATES ARMY • SIMULATION TECHNOLOGY FOR THE WARFIGHTER

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Individual Warfighter Effectiveness and Survivability in a CBRN Threat Environment

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Agenda

- BLUF
- Brief MATREX Overview
- Integrated Capability Goals
- Brief Component Descriptions
  - Infantry Warrior Simulation (IWARS)
  - CBRN Simulation Suite
  - Command, Control and Communications Human Performance Model (C3HPM)
- Integration Description
- Scenario and Future Work
- Summary

BLUF

- MATREX provides a distributed M&S environment for RDECOM and the Army
- A capability to address Chemical-Biological (CB) defense issues focused on high fidelity interactions with the Ground Soldier (GS)/Small Combat Unit (SCU) is lacking
- The integration of the following using MATREX technologies can provide this capability:
  - Natick Soldier Research, Development and Engineering (NSRDEC) IWARS
  - Edgewood Chemical Biological Center (ECBC) CBRN Simulation Suite
  - Army Research Laboratory (ARL) C3HPM

The Individual Warfighter Integrated Capability Project Extends MATREX to represent high fidelity Chem-Bio Effects on the Ground Soldier Small Combat Unit

MATREX Overview

Purpose:

To develop a composable M&S environment wherein a collection of multi-fidelity models, simulations and tools can be integrated and mapped to an established architecture for conducting analysis, experimentation and technology trade-offs for RDECOM and others.

Benefits:

- Enables reconfiguration and reuse of components for:
  - Engineering model development and evaluation
  - Technology tradeoffs
  - Capability assessments
  - Concept development
  - Experimentation
  - Testing
  - Training
- Mutually and collectively leverages the world-class expertise of all RDECOM M&S laboratories for the benefit of the Army as well as Joint services
- Supports decision making over entire acquisition lifecycle

Primary Elements of MATREX:

- Architecture / Environment
- Models & Simulations
- Tools
- Interoperability
- Collaboration

2009 Army Cross Cutting M&S Award

M&S S&T Made Real: Community Use Informs R&D

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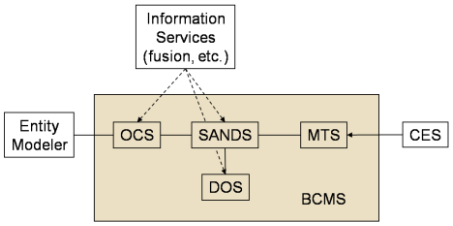
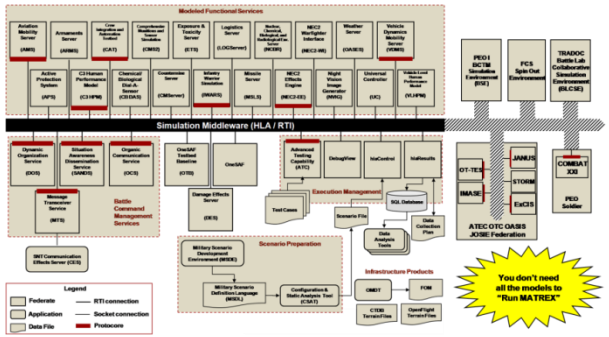
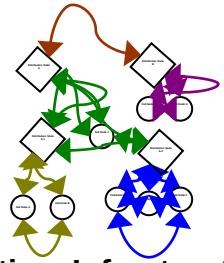
RDECOM Distributed Modeling & Simulation (M&S) Tools



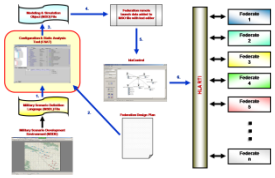
Battle Command Management Services (BCMS)



MATREX Execution Environment

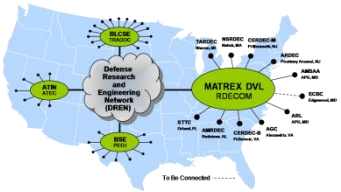


Runtime Infrastructure (RTI)



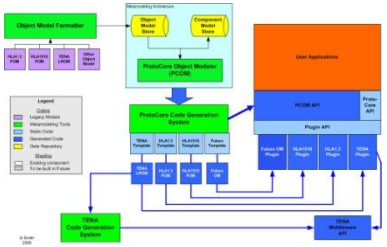
CSAT

Federation Object Model (FOM)



Distributed Virtual Lab (DVL)

Advanced Testing Capability (ATC)



Protocore

Integrated Development Environment (IDE)

MATREX Provides Many Integrated Capabilities and Tools

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Integrated Capability Goals

- Objective: Develop a baseline MATREX distributed simulation capability to address Chem-Bio Defense issues focused on the Ground Soldier (GS) and Small Combat Unit (SCU).

- Issues of importance for Dismounted Infantry (DI) mission outcomes in a CB operational environment:
  - CB Sensor performance, placement and information communicated to the Warfighter
  - The CB threat agent type and the environmental conditions (i.e. weather, terrain)
  - Tactics, Techniques and Procedures (TTPs) related to the current mission and wearing of Mission Oriented Protective Posture (MOPP) gear
  - Protection levels provided by different levels of MOPP gear
  - Ability of Warfighters to perform military tasks such as acquiring a target, aiming a weapon, communication, etc. while wearing MOPP gear

Component Descriptions

- IWARS (NSRDEC) – Representation of dismounted entities and their decisions/physical tasks in battlefield environment (i.e. complex terrain, entity/unit builders, mission builder with tasks/transitions, weather/visibility, 2d/3d visualizers).

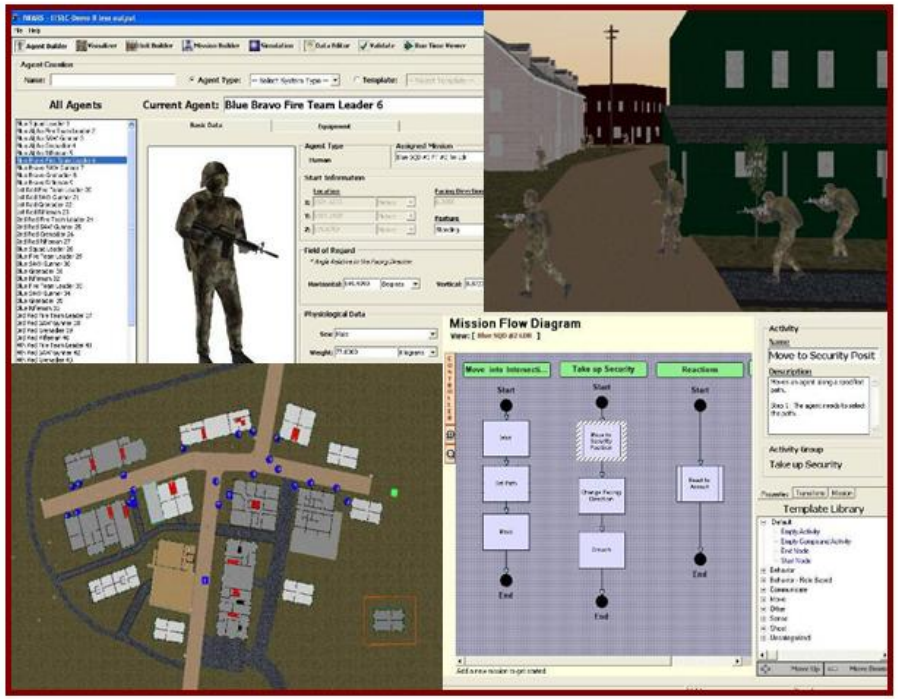
- CBRN Simulation Suite (ECBC) – Dynamic threat events/propagation in complex terrain environment, high fidelity CB sensor representations with tactical message output, CB injury based on exposure dosage/concentration and entity protection.

- C3HPM (ARL) – Task degradation data due to presence of various CB threats and due to wearing of CB protective equipment (e.g. increased acquisition times and weapon firing times, reduced mobility, etc.)

IWARS

The Infantry Warrior Simulation (IWARS) is…

- Analysis-driven
- Entity-based
- Multi-sided simulation
- Focused on individual and small-unit dismounted combatants and their equipment
- Used to assess operational effectiveness across a spectrum of missions, environments, and threats



CBRN Simulation Suite

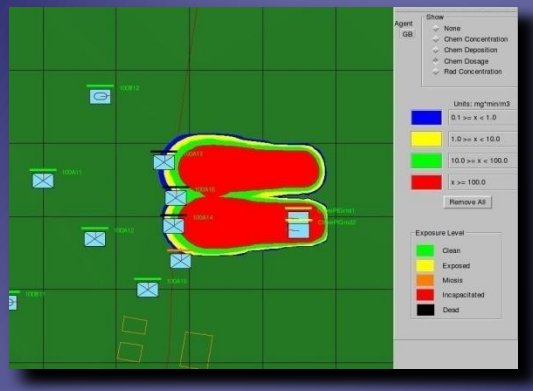
Hazard Transport

Continuous representation of dynamic CBRN hazards over complex terrain

Sensors

Performance, physics, and process based representations of CBRN sensors and sensor reporting

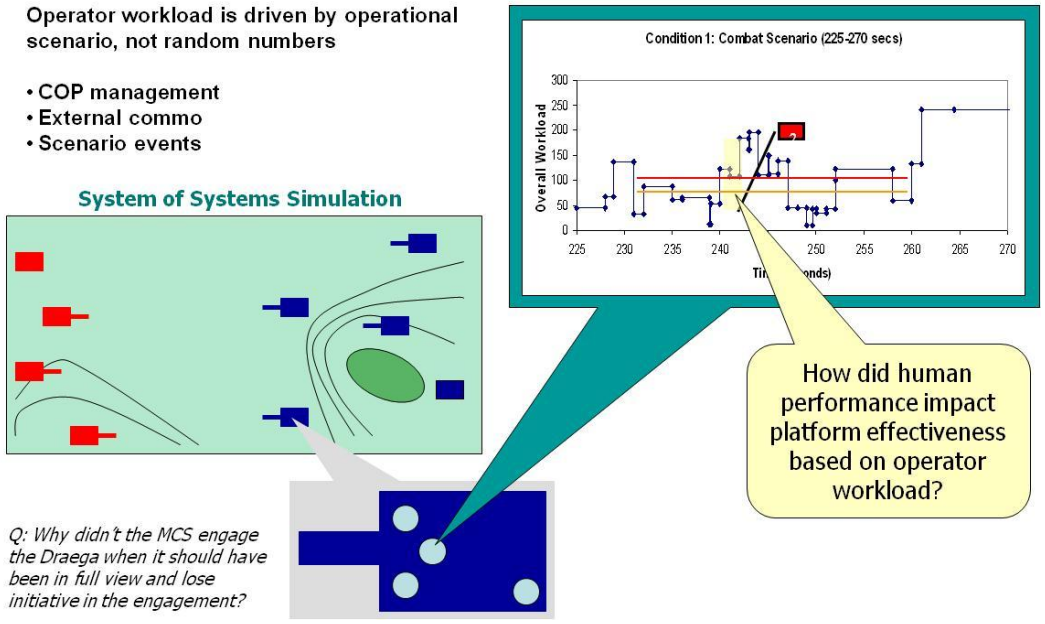
Exposure & Effects



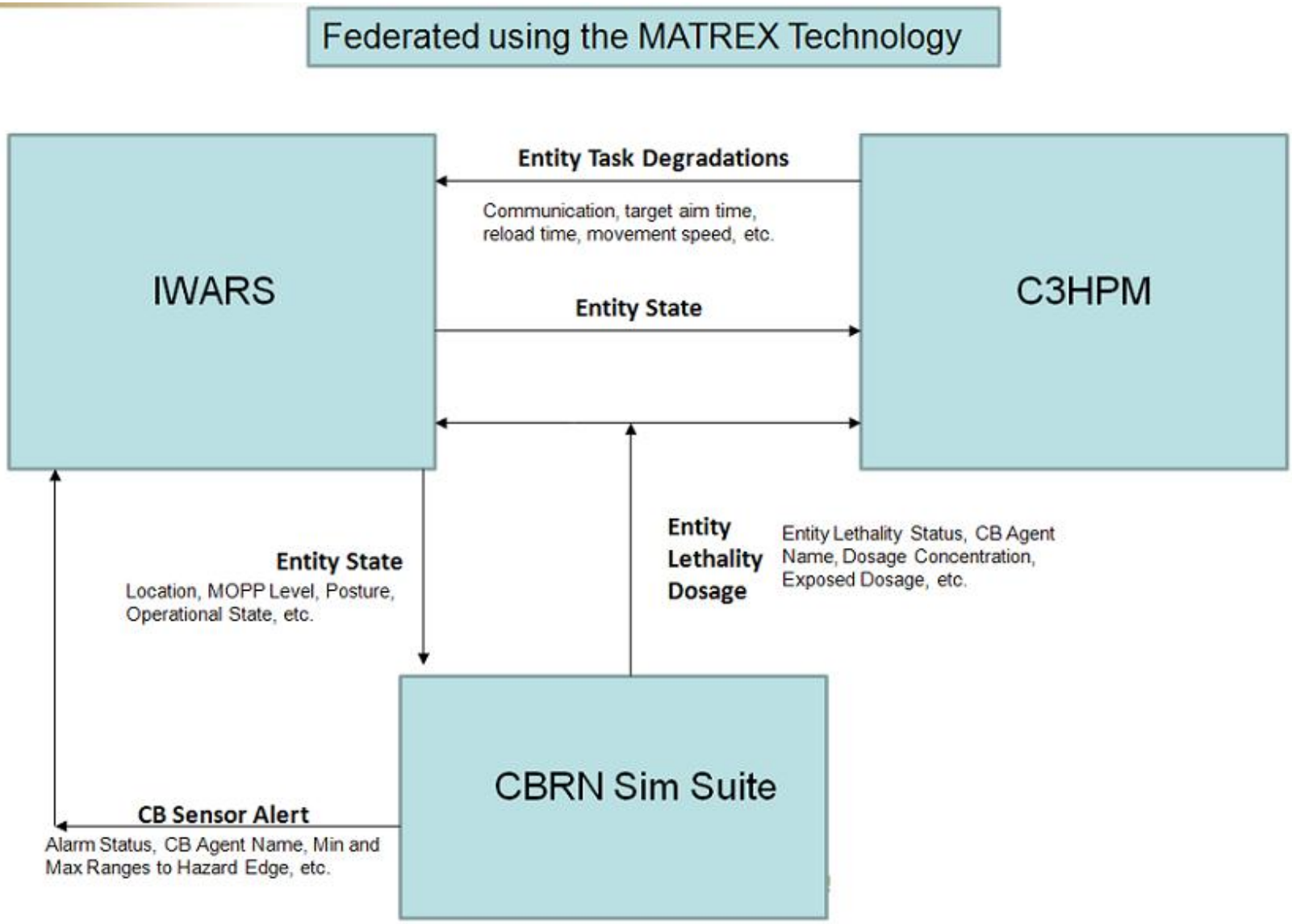
Hazard exposure based on protection status, hazard effect based on toxic load algorithm

C3HPM

- Tool for Human Behavior and Human Performance Modeling
- Based on IMPRINT
- Task Level Analysis
  - Human Timelines
  - Workload
  - Stressors
- Models stored in an Ontology to provide simulation independent representation of behavior

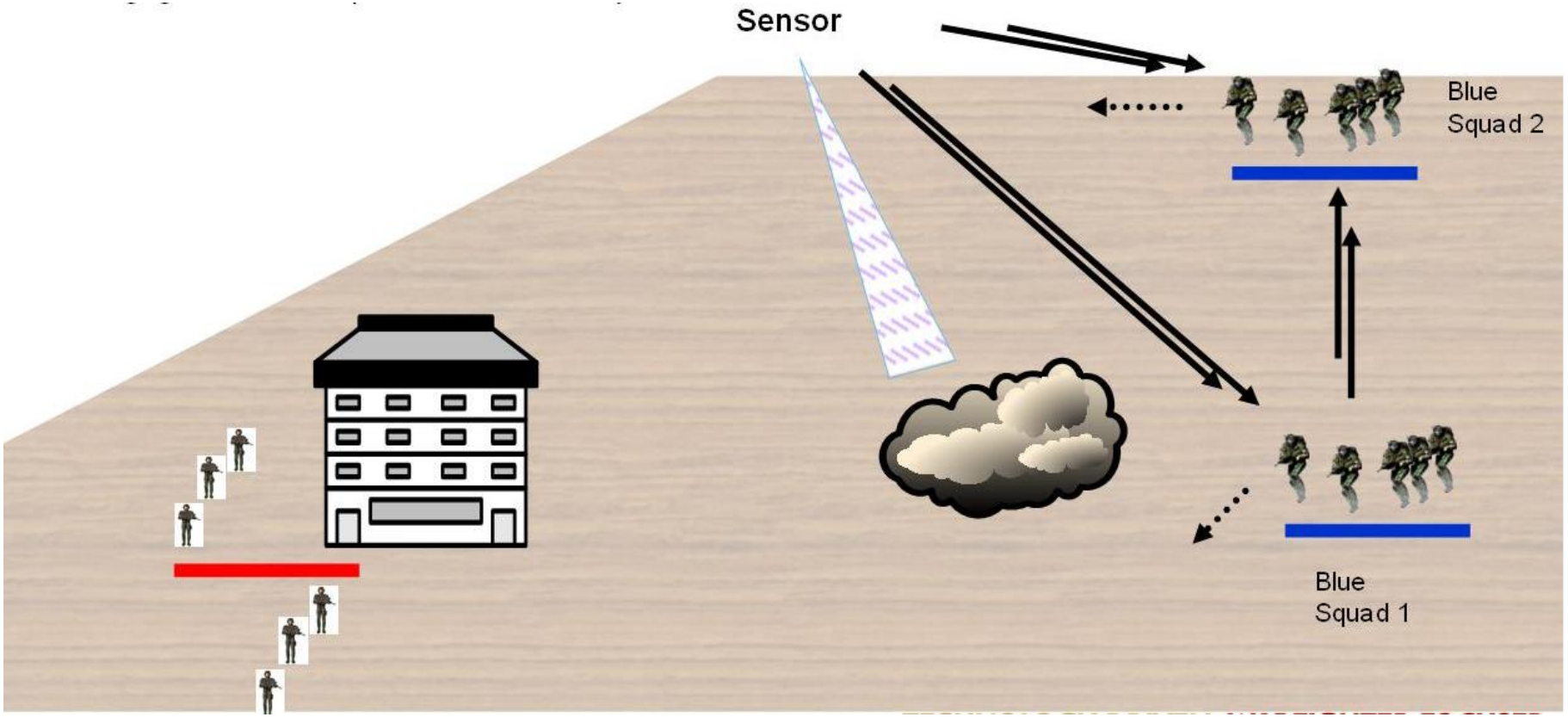


Integration Description

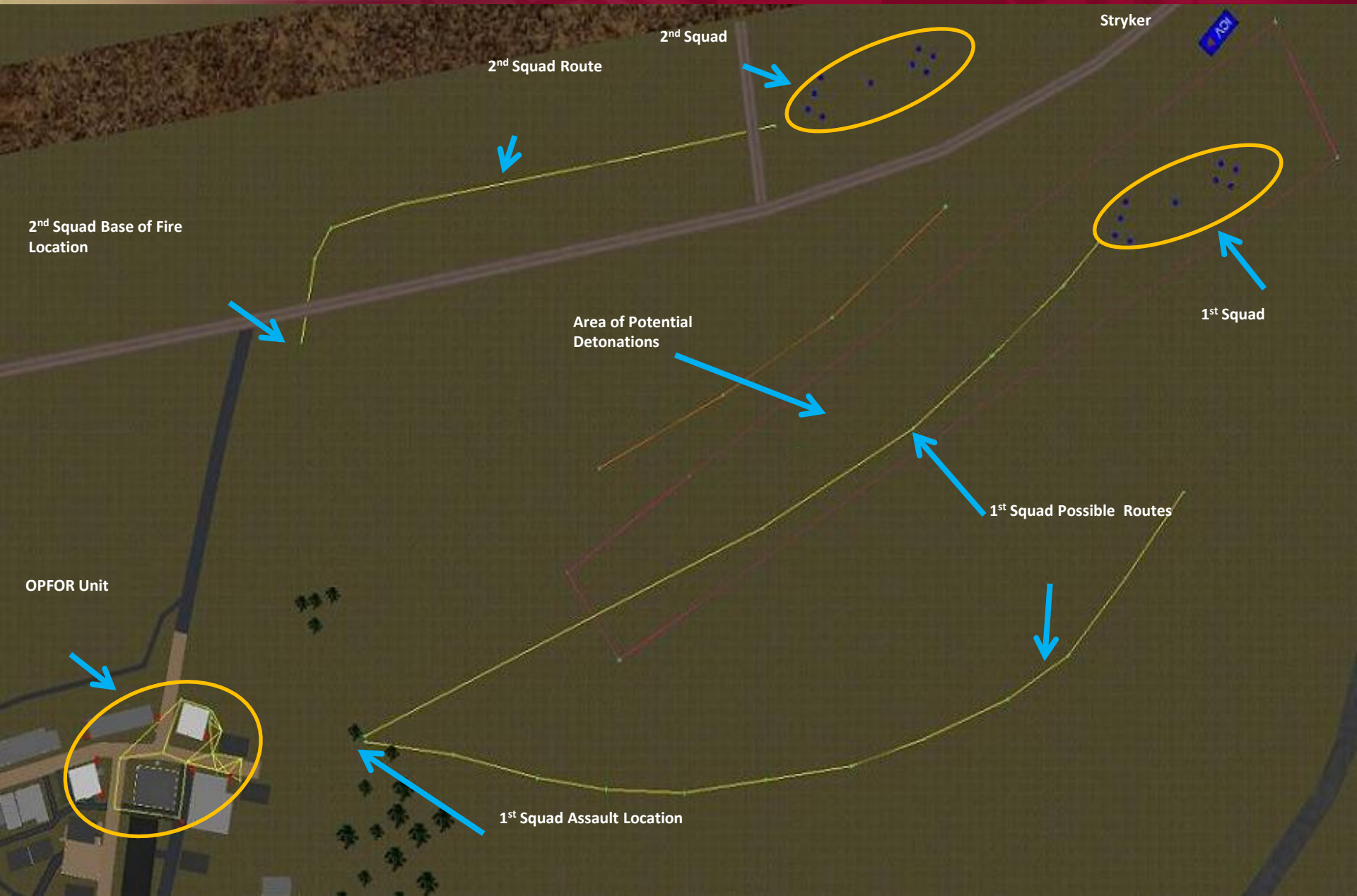


Scenario Concept

Blue Squads 1 & 2 moving toward a built up area where Red Unit resides
CB Threat Event Occurs in Vicinity of Blue Squad 1
CB Sensor detects CB threat and reports to Blue Squads
Blue Squad 1 dons MOPP gear, reports injuries to Squad 2, and changes route
Blue Squad 2 changes route
Engagement takes place in the built up area



Demonstration Scenario



Future Work

- Further integrate C3HPM, IWARS and the CBRN Simulation Suite with OneSAF to extend the CBRN effects to the larger war fight
- Extend the sensor representation to include additional sensor types, e.g. current chemical standoff detectors and lightweight biological detectors
- Extend the effects representation to include additional agent types
- Conduct System of Systems Verification & Validation (V&V)
- Use this suite for a current Joint Program Executive Office for Chem-Bio Defense problem to demonstrate its usefulness

Summary

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Acronyms

- 3CE – Cross-Command Collaborative Effort
- ABCS – Army Battle Command System
- ACS – Aerial Common Sensor
- AKO – Army Knowledge On-Line
- ALCES - Aggregate Level Communications Effects Service
- AMS – Aviation Mobility Service
- AMSWG – (OSD) Acquisition Modeling & Simulation Working Gr
- ARMS – Armaments Service
- ARV – Armed Robotic Vehicle
- ATC – Automated Test Capability
- ATEC – Army Test and Evaluation Command
- ATIN – ATEC Test Integration Network
- ATO – Army Technology Objective
- AUTL – Army Universal Task List
- BCMS – Battle Command Management Services
- BCT – Brigade Combat Team
- BLCSE – Battle Lab Collaborative Simulation Environment
- C2 – Command and Control
- C3HPM – Command, Control, & Communications Human Perfor Model
- C3GRID – Command & Control, Computer GRID
- CASSI – Concepts, Analysis, Systems, Simulation & Integration
- CBRN – Chemical, Biological, Radiological, Nuclear
- CES – Communications Effects Server
- CMS – Countermine Server
- CMS2 – Comprehensive Munitions & Sensor Server
- CSAT – C4ISR Static Analysis Tool
- CTDB – Combat Terrain Database
- C4ISR – Command & Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
- DCARS – Data Collection, Analysis & Reporting System
- DCRA – Data Collection, Reduction and Analysis
- DCA – Data Collection & Analysis
- DCAT – Data Collection & Analysis Tool
- DES – Damage Effects Server
- DIS – Distributed Interactive Simulation
- DDM - Data Distribution Management
- DOS – Dynamic Organization Service
- DREN – Defense Research and Engineering Network
- DTC – Developmental Test Command
- DTE – Distributed Test Event
- DT&E – Developmental Test and Evaluation
- DVL – Distributed Virtual Laboratory
- EE – Effects Engine
- ESS – Embedded Simulation System
- ExCIS - Extensible Command, Control, Communications, Compu and Intelligence Suite
- FBCB2 - Force XXI Battlefield Command Brigade and Below
- FCS – Future Combat Systems
- FCS LSI – Future Combat Systems Lead System Integrator]
- FMFG – FOM Management Focus Group
- FOC – Full Operational Capability
- FOM – Federation Object Model
- FOS – Family of Systems
- FRP – Full Rate Production
- FSE – FCS Simulation Environment
- FUMES - FUsion MEssage Service
- GFX – Government Furnished Equipment
- Hi-FI – High Fidelity
- HLA - RTI – High Level Architecture – Run Time Interface
- HC-NEBC – Human Centric – Network Enabled Battle Command
- HPM – Human Performance Model
- IDE – Integrated Development Environment
- IDEAS - Integrated Data Evaluation & Analysis System
- IED - improvised explosive device
- IEEE - Institute of Electrical and Electronics Engineers, Inc
- IMASE - Intelligence Modeling and Simulation for Evaluation
- IOC – Initial Operational Capability
- IOT&E – Initial Operational Test and Evaluation
- IER – Information Exchange Requirement
- IMASE - Intelligence Modeling and Simulation for Evaluation
- IP03 – Integrated Process 03, Networked Fires
- IRCC-WSMR - Inter-Range Control Center, White Sands Missile Range
- IWARS/DI – Infantry Warrior Simulation/Dismounted Infantry
- JAMUS – Joint Aviation, Missile, and Unmanned Systems (Experimentation Concept)
- JCAS – Joint Close Air Support
- JCIDS – Joint Combat Integrated Defense System
- JOSIE -
- JROC – Joint Requirements Oversight Council
- JSBE – Joint Service Battlespace Environment
- KPP – Key Performance Parameters
- LSI – Lead Systems Integrator (FCS)
- LVC – Live Virtual Constructive
- LVCI - Live Virtual Constructive Interoperability
- LVS – Lethality/Vulnerability Service
- M2MG – M2 machine gun
- MC2 – Mobile Command & Control
- MDA – Model Driven Architecture
- MMIC – MATREX Middleware Independence Capability
- MOA – Memorandum of Agreement
- MOE – Measures of Effectiveness
- MOP – Measures of Performance
- M&S – Modeling and Simulation
- MSDE – Military Scenario Development Environment
- MSDL – Military Scenario Definition Language

MSLS – Missile Service
MSO – PM FCS (BCT) Modeling & Simulation Office
MTS – Message Transceiver Service NCW – Network Centric Warfare
MULE - Multifunctional Utility/Logistics and. Equipment
NEC2 – Networked Effects Command & Control
NLOS – Non-line of sight
NVIG – Night Vision Image Generator
OCS – Organic Communications Service
OneSAF – One Semi-Automated Forces
OOS – OneSAF Objective System
OTB – OneSAF Testbed Baseline
OTC – Operational Test Command
OTM – On-the Move (C4ISR OTM)
OT-TES - Operational Test Tactical Engagements System
PEO – Program Executive Office
PM – Product, or Program or Project Manager
PM ITTS – PM Instrumentation Targets and Threat Simulators
PPB&E – Planning, Programming, Budget and Execution
R2S – Relative Roles Server
RIB – Requirements Integration Board (OneSAF)
ROI – return on investment
RTI – Run time infrastructure
S3E – Systems Engineering, Experimentation, and Enterprise
SANDS – Situational Awareness Normalization & Dissemination Service
SE – Systems Engineering
Sim Init – Simulation Initialization
SME – Subject Matter Expert
SNE – Synthetic Natural Environment
SO1 – Spinout 1 (FCS)
SoS – System of System
SoSE – System of System Engineering
SOSCOE – System of Systems Common Operating Environment
SQL – Structured Query Language (database query language)
S&S – Sustainment & Support
STEM – Science and Technology Enterprise Management
S&T – Science and Technology
SUGV – Small Unmanned Ground Vehicle
TENA – Test & Training Enabling Architecture
TIE – Technical Integration Event
UAV – Unmanned Aerial Vehicle
UC – Universal Controller
UJTL – Universal Joint Task List
VDMS – Vehicle Dynamics & Mobility Service
V&V – Verification and Validation
VV&A – Verification, Validation & Accreditation
WECM – Warfighter Electronic Collection and Mapping

- WI – Warfighter Interface

BACKUPS